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Effect of plant growth regulators and fungicides on intensity of fruit drop of Ambia Bahar in Nagpur Mandarin

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ABSTRACT

Fruits retained on each tree under study were counted prior to first application of spray. Fruit dropped were counted at weekly interval and classified into physiological, pathological and entomological fruit drop. Intensity of physiological and pathological fruit drop was minimum *i.e.* 5.93 % and 1.04 %, respectively with T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) while however entomological fruit drop was not significantly influenced by plant growth regulators and fungicides. Maximum days (290 days) required for maturity was observed with T_5 (2,4-D 10 ppm + Carbendazim 0.1%). Maximum cost benefit ratio (1:2.72) in treatment T5 (2,4-D 10 ppm + Carbendazim 0.1%).

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Key words : Nagpur Mandarian, Plant growth regulators, Intensity of fruit drop

INTRODUCTION

Citrus is grown in 49 countries of the world and it is choicest fruit having high consumer preference both as a fresh fruit as well as refreshing processed juice. Brazil ranks first in production followed by USA and China. Other important citrus growing countries are Spain, Mexico, India, Italy, Egypt etc. Maharashtra stand first in area under citrus cultivation *i.e.* 1.54 lakh ha followed by Andhra Pradesh, Punjab, Karnataka, Uttar Pradesh and Bihar. Tamil Nadu ranks first in productivity.

Fruit drop, particularly at pre-harvest stage is a very complex problem and is known to be the net result of lack of adequate production of hormones within the tissue of plant, nutrient deficiency and pathological causes resulting in heavy monitory loss. Under adverse conditions, the losses go to such an extent that, it renders the citrus cultivation unprofitable to the orchardists. Pre-harvest fruit drop is occurs mostly due to physiological factors mostly due to formation of abscission layer, pathological factors *i.e.* due to stylar end rot and stem end rot and also due to entomological factors.

In India, the problem of pre-harvest fruit drop in citrus has not been tackled extensively, although some work using plant growth regulators only has been done, but hardly any attempt has so far been made to evaluate the relative efficacy of plant growth regulators when mix with other material.

Very little attention has been paid to Nagpur mandarin and thus little information is available on the effect of plant growth regulators and fungicides on pre-harvest fruit drop in Nagpur mandarin.

The investigation of many research workers such as Sharma and Randhawa (1967), Jawanda *et al*. (1972) also observed that several plant growth regulators minimizes fruit drop to a considerable extent.

Keeping in view the past research work on controlling pre-harvest fruit drop by using growth regulators and fungicides, a very limited research work have been carried out on above aspect under this region particularly in Nagpur mandarin. Present investigation entitled "Effect of plant growth regulators and fungicides on intensity of fruit drop of Ambia bahar in Nagpur mandarin" is undertaken.

MATERIALS AND METHODS

The present was carried out on 18 year old Nagpur mandarin trees.

Climate and weather conditions:

Akola has got dry summer and moderately cold winter. During summer, maximum temperature range is 41.3 to 45.05^{0}C and 7 to 10^{0}C in winter as minimum temperature. While maximum relative humidity is 60.94 per cent and 31.23 per cent is minimum. In winter, December is the coolest month with 10^{0}C temperature.

Experimental details:

From 18-year-old mandarin orchard, 72 trees of uniform growth were selected for study.

Crop : Mandarin *Citrus reticulata* Blanco)

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Variety	:	Nagpur mandarin
Year of planting	:	1987
Age of tree	:	18 year
Spacing	:	6 X 6
Number of trees / treatment	:	2
Total number of experimental trees	:	72
Experimental design:		RBD
Replication	:	4
Number of treatments	:	9
Location	:	Private orchard of Nagpur mandarin, Kamargaon, Tahasil Murtizapur, District Akola (M.S.).

Treatment details:

T_1 - 2,4-D 10 ppm
T_2 - NAA 10 ppm
T_3 - Carbendazim 0.1%
T_4 - Copper oxychloride 0.3%
T_5 - 2,4-D 10 ppm + Carbendazim 0.1%
T_6 - NAA 10 ppm + Carbendazim 0.1%
T_7 - 2,4-D 10 ppm + Copper oxychloride 0.3%
T_8 - NAA 10 ppm + Copper oxychloride 0.3%
T_9 - Control (no spray)

Two trees of Nagpur mandarin were taken as a treatment unit and replicated four times. The experiment was started from August, two spray of plant growth regulators and fungicides were given in the first week of August and September (before commencement of pre-harvest fruit drop).

Fruits retained on each tree under study were counted prior to first application of spray. Fruit dropped were counted at weekly interval and classified into physiological, pathological and entomological fruit drop.

Cultural operations:

The plot were kept free from weeds by attending timely spraying of weedicide and followed another cultural operations such as manuring and fertilization. Plant protection measures and irrigation were undertaken uniformly at appropriate time.

Nutritional supply:

The recommended dose of 1200g N, 400g P_2O_5 and 400g K_2O per tree was given along with 50 kg FYM. Half dose of Nitrogen and full dose of P_2O_5 and K_2O were applied in the second week of January and remaining half dose of nitrogen (600g) was applied in first week of March.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been summarized under following heads:

Intensity of fruit drop (physiological, entomological and pathological):

The dropped fruits from experimental trees were collected and classified in to physiological, entomological and pathological fruit drop at weekly interval.

Days required for maturity of fruits:

Maturity of fruits was expressed early, mid and late in days. Number of days required for fruit maturity in each treatment was counted.

Cost benefit ratio:

All the technologies and package of practices were followed as per the schedule and requirement including the additional expenditure incurred on each treatment. From total income and total expenditure, cost benefit ratio was worked out.

Quality parameters of retened and dropped fruits:

Ten retened and dropped fruits were selected in the month of September, October and November for comparative analysis were carried out in respect of average weight, volume, TSS, acidity and ascorbic acid content in fruit juice.

The data recorded in respect to above parameters were subjected to statistical analysis and for interpretation of results. The Randomized Block Design (RBD) is used for statistical analysis (Gomez and Gomez, 1984).

Intensity of physiological, entomological and pathological fruit drop of Ambia bahar in Nagpur mandarin:

The Intensity of physiological, entomological and pathological fruit drop was calculated on total pre-harvest fruit drop of Ambia bahar in Nagpur mandarin during August to December and the findings obtained are presented in Table 1.

Data presented in Table 1. shows that growth regulators and fungicides were significantly influenced on physiological and pathological fruit drop of Ambia bahar in Nagpur mandarin. Entomological fruit drop was not significantly influenced by plant growth regulators and fungicides.

The physiological pre-harvest fruit drop was recorded minimum (5.92 %) in treatment T5 (2,4-D 10 ppm + Carbendazim 0.1 %) and was found significantly superior

Table 1 : Effect of plant growth regulators and fungicides on intensity of physiological, entomological and pathological fruit drop of Ambia bahar in Nagpur

Treatments	Fruit drop (%)		
	Physiological	Entomological	Pathological
T_1 - 2,4-D 10 ppm	8.35 (2.89)	4.31 (2.08)	4.98 (2.23)
T_2 - NAA 10 ppm	11.06 (3.32)	4.46 (2.11)	4.83 (2.20)
T_3 - Carbendazim 0.1%	19.88 (4.55)	4.07 (2.02)	1.23 (1.11)
T_4 - Copper oxychloride 0.3%	21.13 (4.59)	4.16 (2.04)	2.27 (1.50)
T_5 - 2,4-D 10 ppm + Carbendazim 0.1%	5.92 (2.43)	4.06 (2.02)	1.04 (1.03)
T_6 - NAA 10 ppm + Carbendazim 0.1%	8.04 (2.83)	5.11 (2.26)	2.13 (1.48)
T_7 - 2,4-D 10 ppm + Copper oxychloride 0.3%	9.45 (3.07)	4.42 (2.17)	1.18 (1.10)
T_8 - NAA 10 ppm + Copper oxychloride 0.3%	9.61 (3.10)	5.07 (2.25)	2.21 (1.49)
T_9 - Control (no spray)	21.92 (4.68)	5.68 (2.39)	5.49 (2.35)
'F' test -	Sig.	N.S.	Sig.
S.E.(m) ±	0.128	0.093	0.058
C.D. (P=0.05)	0.372	-	0.165
C.V. %	7.324	8.737	7.301

(Note: Figures in parenthesis are square root transformation)

over all other treatments.

The minimum pathological pre-harvest fruit drop (1.04 %) was recorded in treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) and was found at par with treatment T_7 (2,4-D 10 ppm + Copper oxychloride 0.3 %) and T_3 (Carbendazim 0.1%).

Most of the workers obtained minimum intensity of physiological and pathological fruit drop due to the application of plant growth regulators and fungicides, which support the present out come. Gill *et al.* (1983) observed the minimum intensity of fruit drop (physiological and pathological) with the application of 2,4-D (15ppm), Bordomixture (2:2:250) and Zink sulphate (0.5 %) in sweet orange.

Singh *et al.* (1999) found the minimum intensity of pre-harvest fruit drop with the application of Bavistin (0.1 %) and Blitox (0.3 %) in combination with of 2,4-D 10 ppm in Kinnow mandarin.

Days required for maturity of fruits:

Effect of growth regulators and fungicides on days required for maturity of fruits are presented in Table 2.

The data presented in Table 2 reveals that the days required for maturity of fruits of Nagpur mandarin were significantly influence by foliar application of growth regulators and fungicides. Maturity period of fruits was found maximum (290 days) with treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) and was at par with T_7 (2,4-D 10 ppm + Copper oxychloride 0.3 %), T_8 (NAA 10 ppm + Copper oxychloride 0.3 %), T_6 (NAA 10 ppm + Carbendazim 0.1 %), T_1 (2,4-D 10 ppm) and T_2 (NAA 10 ppm).

Table 2 : Effect of plant growth regulators and fungicides on days required for maturity of fruits of Ambia bahar in Nagpur mandarin

Treatments	Days required for maturity of fruits
T_1 - 2,4-D 10 ppm	283
T_2 - NAA 10 ppm	280
T_3 – Carbendazim 0.1%	278
T_4 – Copper oxychloride 0.3%sss	276
T_5 - 2,4-D 10 ppm + Carbendazim 0.1%	290
T_6 - NAA 10 ppm + Carbendazim 0.1%	283
T_7 - 2,4-D 10 ppm + Copper oxychloride 0.3%	287
T_8 - NAA 10 ppm + Copper oxychloride 0.3%	284
T_9 – Control (no spray)	270
'F' test -	Sig.
S.E.(m) ±	2.98
C.D. (P=0.05)	8.700
C.V. %	2.119

Effect of plant growth regulators and fungicides on cost benefit ratio of Ambia bahar in Nagpur mandarin:

Considering the normal cost of cultivation and additional cost incurred for control of fruit drop in each treatment in Nagpur mandarin, cost benefit ration was worked out and presented in Table 3. It is observed that the plant growth regulators and fungicides were effectively influenced on cost benefit ratio of Ambia bahar in Nagpur mandarin. Maximum (1:2.72) cost benefit ratio

Table 3 : Effect of plant growth regulators and fungicides on cost benefit ratio of Ambia bahar in Nagpur Mandarian

Treatments	Normal cost of cultivation (Rs,/ha)	Additional cost for control of fruit drop (Rs/ha)	Total cost of cultivation (s/ha)	Yield (fruits/ha in lack)	Total income (Rs/ha in lack)	Cost Benefit Ratio
T_1 - 2,4-D 10 ppm	60873	2460	63333	2.42	1.452	1:2.25
T_2 - NAA 10 ppm	60873	2572	63445	2.37	1.422	1:2.24
T_3 - Carbendazim 0.1%	60873	3180	64053	2.16	1.296	1:2.02
T_4 - Copper oxychloride 0.3%	60873	4284	65157	2.13	1.278	1:1.96
T_5 - 2,4-D 10 ppm + Carbendazim 0.1%	60873	3840	64713	2.93	1.758	1:2.72
T_6 - NAA 10 ppm + Carbendazim 0.1%	60873	3952	64825	2.55	1.530	1:2.36
T_7 - 2,4-D 10 ppm + Copper oxychloride 0.3%	60873	4944	65817	2.62	1.572	1:2.39
T_8 - NAA 10 ppm + Copper oxychloride 0.3%	60873	5056	65929	2.48	1.488	1:2.26
T_9 - Control (no spray)	60873	-	60873	1.86	1.116	1:1.83

Note: growth regulators : 1. 2, 4-D -28 g @ Rs. 20 / g
2. NAA -28 g @ Rs. 24 / g
Aceton : -100 ml @ Rs. 100 /200 ml
Fungicide : 1. carbendazim -2.76 Kg@Rs. 500/ Kg
2. copper oxychloride - 98.25 Kg @ Rs. 300/ Kg
Spraying Charges : - 30 units @ Rs. 60/ day
Fruit rate : - @ Rs. 600/1000 fruit

was observed with treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1%) by producing maximum yield. While minimum (1:1.83) cost benefit ratio was observed with treatment T_9 (control).

Conclusion:

Intensity of physiological and pathological fruit drop was minimum *i.e.* 5.93 % and 1.04 % respectively with T_5 (2,4-D 10 ppm + Carbendazim 0.1%) while however entomological fruit drop was not significantly influenced by plant growth regulators and fungicides. The number of seeds per fruit was not significantly influenced by the application of plant growth regulators and fungicides. Maximum cost benefit ratio (1:2.72) in treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1%).

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